III. REMARKS

Applicants gratefully acknowledge the interview conducted with the Examiner on July 12, 2005, and the discussion at the interview that lead to the Examiner's conclusion that the limitation "wherein each divided cell is classified only as one member of the group consisting of (1) a non-boundary cell not including a boundary surface of the object and located in the interior or in the outside region of the object, and (2) a boundary cell including the boundary surface of the object" is clear and is distinguished over the prior art of record (Examiner's Interview Summary, dated July 12, 2005, at 3).

The specification has been amended to correct an obvious transcription error. Specifically, the substitute specification has been amended to recite that "the pre-designated absolute accuracy may be constrained so that when the cell width is 1 μm, further Octree division is stopped." Persons of ordinary skill in the art would recognize the obvious transcription error because the order of magnitude regarding absolute accuracy in the CAD art is typically on the order of microns and not meters. The transcription error is further evident from the Japanese Priority Document JP 2001-025023 (of record), and from paragraph [0033] of Japanese Publication No. JP 2002-230054, which corresponds to the Japanese Priority Document JP 2001-025023. A copy of Japanese Publication No. JP 2002-230054 is filed herewith. Evidence of the transcription error is also plain from the machine translation, provided by the Japanese Patent Office, of paragraph [0033] of Japanese Publication No. JP 2002-230054. A copy of the machine translation provided by the Japanese Patent Office is filed herewith.

Claims 1, 7, 13, 14 and 20 have been amended. Specifically, independent claims 1, 7 and 20 have been amended to recite "wherein each divided cell is classified only as

one member of the group consisting of (1) a non-boundary cell not including a boundary surface of the object and located in the interior or in the outside region of the object, and (2) a boundary cell including the boundary surface of the object" as supported by Figure 4 of the application as originally filed.

Claims 13 and 14 depend, either directly or indirectly, upon claim 7, and have been amended to include language consistent with the amendments to claim 7.

The present amendment adds no new matter to the instant application.

IV. <u>The Invention</u>

The present invention pertains broadly to a method of storing substantial data integrating shape and physical properties such as would be used to store substantial data integrating shape and physical properties of an object so that the data can be stored in a small storage capacity. In particular, in a first embodiment in accordance with the present invention, a method of storing substantial data integrating shape and physical properties is provided that includes the steps of: (a) an external data input step (A) for inputting external data consisting of boundary data of an object; (b) an Octree division step (B) for dividing, by modified Octree division, the external data into cubical divided cells with boundary surfaces orthogonal to each other; and (c) a cell data storage step (C) for storing the values of physical properties for each of the cells.

In accordance with a second embodiment of the present invention, a method of storing substantial data integrating shape and physical properties is provided that includes the following steps: (a) inputting to a computer external data consisting of boundary data of an object; (b) dividing, by modified Octree division, the external data into cubical first

cells with boundary surfaces orthogonal to each other; and (c) storing the values of physical properties for each of the first cells.

In accordance with a third embodiment of the present invention, a method of storing substantial data integrating shape and physical properties is provided that includes the steps recited in claim 20.

In all of the embodiments, in accordance with the present invention, inputted external data is divided into cells using modified octree division, which requires classifying cells as only one member of the group consisting of (1) a non-boundary cell not including a boundary surface of the object and located in the interior or the outside region of the object and (2) a boundary cell including the boundary surface of the object, wherein the modified Octree division comprises the steps of: (i) re-dividing by Octree division only boundary cells, wherein each boundary cell is divided into smaller cells, and each smaller cell is then classified as either a non-boundary cell or a boundary cell; and (ii) acquiring cut points by replacing each boundary cell, either strictly or approximately, by cut points on twelve ridge lines in three dimensions and on four ridge lines in two dimensions, wherein re-division of only boundary cells is performed until sufficient cut points are acquired to reconstruct boundary shape elements, including boundary surfaces, included in the external data.

Various other embodiments in accordance with the present invention are recited in the dependant claims. An advantage of the various embodiments, in accordance with the present invention, is that a method of storing substantial data integrating shape and physical properties is provided that more efficiently stores substantial data so that smaller storage capacities can be utilized during CAD and simulation operations. Furthermore,

the methods in accordance with the present invention actually allow for the integration of CAD and simulation operations because the modified Octree division makes it possible to manage information related to both procedures.

V. The Rejections

Claims 1, 4, 7, 10 and 13-15 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the Kela reference (Ajay Kela, *Hierarchical octree approximations for boundary representation-based geometric models*, Computer-Aided Design 355 (1989)) in view of Shu et al. (U.S. Patent 6,075,538). Claims 5, 11 and 16 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of the Kela reference and the Shu Patent, and further in view of the Shute reference (Gary Shute, *Overview of C Programming, at* http://www.d.umn.edu/~gshute/C/overview.html (last modified Aug. 23, 1999)). Claims 6, 12, 17 and 19 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of the Kela reference and the Shu Patent, and further in view of Dundorf (U.S. Patent 5,197,013). Claims 20 and 21 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of the Kela reference, the Shu Patent, the Shute Reference, and further in view of the Dundorf Patent.

Applicants respectfully traverse the rejection and request reconsideration of the instant application for the following reasons.

VI. Applicants' Arguments

A patentability analysis under 35 U.S.C. § 103 requires (a) determining the scope and content of the prior art, (b) ascertaining the differences between the prior art and the

claimed subject matter, (c) resolving the level of ordinary skill in the pertinent art, and (d) considering secondary considerations that may serve as indicia of nonobviousness or obviousness. Graham v. John Deere Co. of Kansas City, 148 U.S.P.Q. 459, 467 (1966). Furthermore, the Federal Circuit has held that to reject claimed subject matter in view of a combination of prior art references, a proper analysis under 35 U.S.C. § 103 must show that (a) the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, (b) the prior art reveals that in so making, one of ordinary skill would have a reasonable expectation of success, and (c) both the suggestion and the reasonable expectation of success is found in the prior art and not in applicant's disclosure. In re Vaeck, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991). In the present case, the scope of the prior art is insufficient to support the Examiner's Section 103 rejection.

A. The Kela Reference

The Kela reference teaches "hierarchical octree approximations for boundary representation-based geometric models" that includes an octant classification procedure, as shown in Figure 1, using three types of octants: (i) "IN" octants, which are located wholly in the interior of the solid object, (ii) "OUT" octants, which are located wholly outside of the solid object, and (iii) "NIO" octants, which are boundary octants being neither wholly inside or wholly outside of the solid object (Kela reference, at 355, col. 2, lines 2-20).

For this reason alone, the Kela reference cannot teach, or even suggest, the step wherein "each divided cell is classified only as one member of the group consisting of (1) a non-boundary cell not including a boundary surface of the object and located in the interior or in the outside region of the object, and (2) a boundary cell including the boundary surface

of the object" as recited in independent claims 1, 7 and 20 of the present application.

In accordance with the present invention, cells are classified as either non-boundary cells or boundary cells. In accordance with the present invention, non-boundary cells do not include the boundary surface of the object, and boundary cells must include the boundary surface of the object. <u>There are no other kinds of cells besides these two kinds</u>. On the other hand, the Kela reference teaches classifying cells into three types of cells: IN octants (i.e., cells located inside the object), OUT octants (i.e., cells located outside the object), and NIO octants (i.e., boundary cells) as admitted by the Examiner (Office Action, dated April 7, 2005, at 2, lines 20-24; and Office Action, dated November 16, 2004, at 4, lines 16-21).

A person of ordinary skill in the art would recognize that the method of the presently claimed invention utilizes a 2-dimensional matrix (non-boundary, boundary) for dividing and classifying the external data, while the method taught by the Kela reference utilizes a 3-dimensional matrix (IN, OUT, NIO) for this purpose. Clearly, a 2-dimensional matrix is simpler and more easily and quickly calculable than a 3-dimensional matrix.

As admitted by the Examiner, the Kela reference does not teach the step of "storing the values of physical properties" as recited in claims 1, 7 and 20 (Office Action, dated April 7, 2005, at 3, lines 17-18; and Office Action, dated February 17, 2004, at 4, lines 9-10; and Office Action, dated November 16, 2004, at 3, lines 20-21).

These are not the only deficiencies in the teachings of the Kela reference. The Kela reference teaches a conventional Octree division method, whereas the present invention as recited in claims 1, 7 and 20 performs "dividing, by modified Octree division." The Examiner's attention is directed to Figures 7A and 7B of the present application, which illustrate the difference between conventional Octree division (see

Figure 7A) and modified Octree division (see Figure 7B). Applicants' "modified Octree division" is fully described on page 9, line 25, to page 10, line 14, of the specification as originally filed. Claims 1, 7 and 20, in accordance with the present invention, recite that "modified Octree division comprises the steps of: i. re-dividing by Octree division only boundary cells, wherein each boundary cell is divided into smaller cells, and each smaller cell is then classified as either a non-boundary cell or a boundary cell; and ii. acquiring cut points..., wherein re-division of only boundary cells is performed until sufficient cut points are acquired to reconstruct boundary shape elements, including boundary surfaces...."

In other words, the "modified Octree division," in accordance with the present invention, requires "acquiring cut points" so "re-division of only boundary cells is performed until sufficient cut points are acquired to reconstruct boundary shape elements." On the other hand, the algorithm taught by the Kela reference recursively subdivides NIO octants "until a desired level of accuracy is achieved" (third page, right column, 10-11). Therefore, <u>the Kela reference is completely silent regarding how to stop the subdivision process</u>. The Kela reference absolutely does not teach, or even suggest, "acquiring cut points" and re-dividing only boundary cells "until sufficient cut points are acquired to reconstruct boundary shape elements" as recited in claims 1, 7 and 20.

On the other hand, the specification on page 13, line 24, to page 14, line 9, as originally filed, describes the resolution of the method, in accordance with the present invention, in terms of absolute accuracy. Paragraph [0051] of the substitute specification, filed June 14, 2004, has been amended to describe the absolute accuracy of the modified Octree division to a cell width of 1 micron, wherein the modified Octree division of the

present invention is stopped, as supported by the Japanese Priority Document JP 2001-025023, the Japanese Publication No. JP 2002-230054, and the JPO machine translation of paragraph [0033] of the Japanese Publication No. JP 2002-230054. Because the method of the present invention employs a cut point based reconstruction of the object surface, the method of the present invention requires fewer divisions than conventional Octree division, such as taught by the Kela reference.

Persons of ordinary skill in the art would immediately recognize from Figures 7A and 7B that "modified Octree division" in accordance with claims 1, 7 and 20 of the present invention is superior over conventional Octree division shown in Figure 7A because less data points are required to map the surface of the same object. The present invention requires less division than convention Octree division due to the use of the cut-point based reconstruction of the surface of an object. Furthermore, persons of ordinary skill in the art would recognize that the Kela reference teaches a ClassFace operation that employs three or four boundary cells such as a face cell, an edge cell, and vertex cells (types I and II). See Kela reference, second page, left column, lines 16-46. Consequently, the Kela reference requires three or four data structures, so the data is heavy, enormous, and much processor time is needed. On the other hand, the present invention employs only one type of "boundary cell," and the boundary cell is expressed by cut points as described on page 9, line 10+, and by Figures 3 and 7B of the application as originally filed. Therefore, the data structure required for a boundary cell of the present invention does not change during the storing method of the present invention, which means the data is kept relatively small and simple, less processing time is needed, and the data is robust.

The Kela reference also fails to teach, or even suggest, (a) that each "non-boundary

cell has one kind of physical property value as an attribute, and each boundary cell has two kinds of physical property values relating respectively to the interior of the object and to regions outside of the object" as recited in claims 4, 10, 15 and 20 (Office Action, dated April 7, 2005, at 4, lines 15-17; and Office Action, dated February 17, 2004, at 6, lines 17-19); (b) that the "physical values consist of constant values which do not change by simulation, and variables which change as a result of simulation" as recited in claims 5, 11, 16 and 20 (Office Action, dated April 7, 2005, at 6, lines 4-6; Office Action, dated February 17, 2004, at 8, lines 6-8; and Office Action, dated November 16, 2004, at 7, lines 1-3, and at 10, lines 9-11), and (c) that the "external data" is "curved surface data for a three dimensional CAD or CG tool" as recited in claims 6, 12, 17 and 20 (Office Action, dated April 7, 2005, at 7, lines 6-7; Office Action, dated February 17, 2004, page 9, lines 7-8; and Office Action, dated November 16, 2004, at 7, lines 21-22).

In view of all of the apparent deficiencies of the Kela reference outlined above, the Kela reference can neither anticipate, nor render obvious, the subject matter of claims 1, 4-7, 10-17 and 19-21 of the present application.

B. The Shu Patent

The Shu Patent teaches a "time and space efficient data structure and method and apparatus for using the same for surface rendering," which utilizes conventional octrees, preferably summarized information octrees (SIOs), (col. 5, lines 46-65). It is noted that the Shu Patent actually teaches 2-dimensional quadtrees, and merely suggests application to 3-dimensional SIO (col. 5, line 66, to col. 6, line 8). The Shu Patent teaches that in 3-dimensions, the volume data set for a 3-dimensional space scalar field would be partitioned

into NxNxN identical cubes, with each cube having 6 faces and 8 voxels (col. 6, lines 18-34). Each "cube" is also referred to as a "cell," and each cell is classified according to its density value as either a 0-cell, a 1-cell, or an S-cell (col. 1, line 25, to col. 2, line 27). Specifically, Shu defines cells as follows: an 0-cell has, for each of the 8 voxels, a density value less than a threshold value t; a 1-cell has, for each of the 8 voxels, a density value more than the threshold value t; and an S-cell has some voxels with a density value less than t and some voxels with a density value greater than t (col. 2, lines 14-27).

There is nothing in the Shu Patent that teaches, or even suggests, (a) "dividing, by modified Octree division, the external data into cubical ... cells with boundary surfaces orthogonal to each other, wherein each ... cell is classified as only one member of the group consisting of (1) a **non-boundary cell** not including a boundary surface of the object and located in the interior or the outside region of the object, and (2) a **boundary cell** including a boundary surface of the object; (b) that "modified Octree division comprises the steps of: i. re-dividing by Octree division only boundary cells, wherein each boundary cell is divided into smaller cells, and each smaller cell is then classified as either a non-boundary cell or a boundary cell; and ii. acquiring cut points..., wherein re-division of only boundary cells is performed until sufficient cut points are acquired to reconstruct boundary shape elements, including boundary surfaces, included in the external data;" and (c) "acquiring cut points by replacing each boundary cell, either strictly or approximately, by cut points on twelve ridge lines in three dimensions and on four ridge lines in two dimensions" as recited in claims 1, 7 and 20, in accordance with the present invention.

As discussed above, the Shu Patent teaches a three-way classification scheme (i.e., 0-

cell, 1-cell, S-cell) for each cell of the volume data set, which is similar to the three-way classification scheme (i.e., IN, OUT, NIO) taught by the Kela reference. Therefore, the Shu Patent fails to teach the two-way classification of "cells" as either "non-boundary" or "boundary" as recited in claims 1, 7 and 20 of the present invention for the same reasons that the Kela reference fails to teach this limitation. As conceded by the Examiner, the Shu Patent also does not teach, or even suggest, (d) that each "non-boundary cell has one kind of physical property value as an attribute, and each boundary cell has two kinds of physical property values relating respectively to the interior of the object and to regions outside of the object" as recited in claims 4, 10, 15 and 20 (Office Action, dated April 7, 2005, at 4, lines 13-17; and Office Action, dated February 17, 2004, at 4, lines 18-21); (e) that the "physical values consist of constant values which do not change by simulation, and variables which change as a result of simulation" as recited in claims 5, 11, 16 and 20 (Office Action, dated April 7, 2005, at 6, lines 3-6; Office Action, dated February 17, 2004, at 8, lines 6-8; and Office Action, dated November 16, 2004, at 7, lines 1-3, and at 10, lines 9-11), and (f) that the "external data" is "curved surface data for a three dimensional CAD or CG tool" as recited in claims 6, 12, 17 and 20 (Office Action, dated April 7, 2005, lines 7, lines 6-7); Office Action, dated February 17, 2004, page 9, lines 7-8; and Office Action, dated November 16, 2004, at 7, lines 21-22).

C. <u>The Shute Reference</u>

The Shute reference provides an "Overview of C Programming," and defines a "variable" and a "constant." Specifically, the Shute reference teaches that a "variable is a named or unnamed place for storing mutable data...declared globally...or local to a

function" (Shute reference, at 1, lines 25-27). On the other hand, the Shute reference teaches that "a constant is a named or unnamed non-mutable program value...defined by preceding an initialized variable definition with a keyword constant" (Shute reference, at 5, lines 5-7). All the Shute reference teaches is that variables and constants are elements of C Programming. The scope of the teachings of the Shute reference is extremely limited.

The Shute reference does not teach, or even suggest, that the "physical values consist of constant values which do not change by simulation, and variables which change as a result of simulation" as recited in claims 5, 11, 16 and 20 of the present application. In other words, the Shute reference does not teach, or even suggest, that "physical values consist of constant values...and variables" as recited in the instant claims.

D. The Dundorf Patent

The Dundorf Patent teaches a "method of forming a carved sign using an axially rotating carving tool," which relates to producing a carved sign using a CAD/CAM computer (col. 7, lines 1-10). The Dundorf Patent teaches an application of the parametric cubic curve to geometrical and graphical modeling (col. 9, line 19, to col. 12, line 55), and suggests that conventional Octree encoding can be used as a data structure for representing a three-dimensional object (col. 17, lines 18-40). However, the Dundorf Patent does not teach, or even suggest, (a) "modified Octree division," (b) the two-way classification of "cells" as either "non-boundary" or "boundary," and (c) the step of "acquiring cut points" as recited in claims 1, 7 and 20 in accordance with the present invention.

E. Summary of the Prior Art

It is apparent that neither the Kela reference, the Shu Patent, the Shute reference nor the Dundorf Patent teach, or even suggest, (a) "dividing, by modified Octree division, the external data into cubical ... cells with boundary surfaces orthogonal to each other, wherein each... cell is classified as only one member of the group consisting of (1) a **non-boundary cell** not including a boundary surface of the object and located in the interior or the outside region of the object, and a **boundary cell** including a boundary surface of the object;" (b) that "modified Octree division comprises the steps of: i. re-dividing by Octree division only boundary cells, wherein each boundary cell is divided into smaller cells, and each smaller cell is then classified as either a non-boundary cell or a boundary cell; and ii. acquiring cut points..., wherein re-division of only boundary cells is performed until sufficient cut points are acquired to reconstruct boundary shape elements, including boundary surfaces, included in the external data;" and (c) "acquiring cut points by replacing each boundary cell, either strictly or approximately, by cut points on twelve ridge lines in three dimensions and on four ridge lines in two dimensions" as recited in claims 1, 7 and 20, in accordance with the present invention.

As discussed above, both the Kela reference and the Shu Patent teach dividing object data into cells classified in three dimensions. The mapping paradigms taught by the Kela reference and the Shu Patent would be inoperative if cell division were limited to only two classifications.

The Federal Circuit has ruled that a proposed modification of the prior art that obliterates a feature taught by the prior art, thereby rendering operation impaired, is not

permitted to create a prima facie case of obviousness. McGinley v. Franklin Sports Inc., 60 U.S.P.Q.2d 1001, 1010 (Fed. Cir. 2001). In the present case, there is simply no suggestion grounded in the prior art to contract the 3-dimensional cellular matrices taught by the Kela reference and the Shu Patent into a 2-dimensional cellular matrix (i.e., boundary and non-boundary cells), which is a recited feature in claims 1, 7 and 20 of the present invention. Furthermore, a person of ordinary skill in the art would not have a reasonable expectation that the methods taught by the Kela reference and the Shu Patent would be operative if such a conversion were carried out.

In addition, the individual references cannot be employed under 35 U.S.C. § 103 as an impermissible mosaic to recreate a facsimile of the claimed invention. Northern Telecom, Inc. v. Datapoint Corp., 15 U.S.P.Q.2d 1321, 1323 (Fed. Cir. 1990). In the present case, the Shute reference only teaches that variables and constants are used in C Programming. The scope of the teachings of the Shute reference does not include programming "physical property values" to "consist of constant values...and variables" as recited in claims 4, 10, 15 and 20. Any application of the Shute reference to the teachings of the Kela reference and the Shu Patent lacks a proper suggestion grounded in the prior art to justify employing both constant values and variables to "physical property values;" therefore, the proposed combination is an improper facsimile created by the Examiner from a prohibited mosaic of the prior art.

The Dundorf Patent cannot make up the multiple deficiencies in the teachings of the Kela reference, the Shu Patent and the Shute reference. In particular, the teachings of the Dundorf Patent are limited to showing that parametric cubic curves can be applied to geometrical and graphical modeling, which includes methods employing conventional

Octree division. The Dundorf Patent does not teach, or even suggest, (a) "dividing, by modified Octree division...," (b) classifying "each....cell...as only one member of the group consisting of a non-boundary cell...or a boundary cell..., and (c) "acquiring cut points..." in accordance with claims 1, 7 and 20 of the present invention.

F. Claim 20

In order to establish a prima facie case of obviousness over claim 20 of the present application, the Examiner must show a proper suggestion, grounded in the prior art and not Applicants' disclosure, to justify combining the Kela reference, the Shu Patent, the Shute reference and the Dundorf Patent. However, the Examiner has not established a proper suggestion grounded in the prior art to support such a combination. Furthermore, the scope and content of the prior art would still fail to teach, or even suggest, (a) "dividing, by modified Octree division, the external data into cubical ... cells with boundary surfaces orthogonal to each other, wherein each... cell is classified as only one member of the group consisting of (1) a **non-boundary cell** not including a boundary surface of the object located in the interior or the outside region of the object, and (2) a **boundary cell** including the boundary surface of the object; (b) that "modified Octree division comprises the steps of: i. re-dividing by Octree division only boundary cells, wherein each boundary cell is divided into smaller cells, and each smaller cell is then classified as either a non-boundary cell or a boundary cell; and ii. acquiring cut points..., wherein re-division of only boundary cells is performed until sufficient cut points are acquired to reconstruct boundary shape elements, including boundary surfaces, included in the external data;" and (c) "acquiring cut points by replacing each boundary cell, either strictly or approximately, by cut points on twelve ridge

lines in three dimensions and on four ridge lines in two dimensions" as recited in claims 1, 7 and 20, in accordance with the present invention.

G. Claims 19 and 21

Claims 19 and 21 recite the additional step of "expressing corner points by cut points possessed by adjacent boundary cells." The Examiner contends the "vertices" of a given boundary octant, which are shared by another given boundary octant, are considered "cut points" and cites Figure 3 of the Kela reference in support of this position (Office Action, April 7, 2005, at 8, lines 9-11; and Office Action, dated November 16, 2004, at 6, lines 15-17). However, "corner points" are defined by Figure 4 of the present application, as originally filed, to include "points" (16) that are not generally shared by "another given boundary octant" as misconstrued by the Examiner. A person of ordinary skill in the art would immediately recognize that the Examiner's position is not consistent with the definition of "corner point" provided by the present application or by any teaching in the Kela reference. To make this issue perfectly clear, Figure 4 (as originally filed) of the present application is reproduced below.

skill in the pertinent art resolved, a Section 103 patentability analysis further requires consideration of evidentiary indicia of nonobviousness or obviousness. Graham v. John Deere Co. of Kansas City, 148 U.S.P.Q. 459, 467 (1966); Arkie Lures Inc. v. Gene Larew Tackle Inc., 43 U.S.P.Q.2d 1294, 1297 (Fed. Cir. 1997). The recognition of the merits of the invention by others is evidence of nonobviousness. Arkie Lures Inc. v. Gene Larew Tackle Inc., 43 U.S.P.Q.2d 1294, 1297 (Fed. Cir. 1997); Burlington Industries v. Quigg, 3 U.S.P.Q.2d 1436, 1437-8 (Fed. Cir. 1987); and Stevenson v. International Trade Commission, 204 U.S.P.Q. 276, 281-2 (C.C.P.A. 1979).

In the present case, Applicants assert that the Examiner has failed to establish a prima facie case of obviousness for all of the reasons evinced above. Assuming, *arguendo*, the Examiner has established a prima facie case (which he has not), Applicants submit the following evidence demonstrating recognition of the merits of the present invention by others. Specifically, Applicants have previously submitted a copy of the article "*Volume CAD*" by Kase et al., published in Volume Graphics, 2003 (See Information Disclosure Statement, filed March 16, 2005). Volume Graphics is a peer-reviewed journal publishing articles within the scope of the pertinent art. The "*Volume CAD*" article demonstrates recognition of the merits of the present invention by others.

Applicants also submit herewith a copy of the article-in-press "*Volume CAD—CW-complexes based approach*" by Kase et al, to be published in Computer-Aided Design. Computer-Aided Design is a peer-reviewed journal publishing articles within the scope of the pertinent art. The "*Volume CAD—CW-complexes based approach*" article, soon to be published, demonstrates further recognition of the merits of the present invention by others.

Therefore, even if the Examiner could establish a prima facie case of obviousness

based on the art of record (which is a burden the Examiner has not met), the evidence of record demonstrates recognition of the merits of the present invention by others in the art, which is of sufficient weight to overcome any prima facie showing of obviousness.

VII. Conclusion

The rejection under 35 U.S.C. § 103 standing against the claims is untenable and should be withdrawn because neither the Kela reference, the Shu Patent, the Shute reference nor the Dundorf Patent teach, or even suggest, (a) "dividing, by modified Octree division, the external data into cubical ... cells with boundary surfaces orthogonal to each other, wherein each ... cell is classified as only one member of the group consisting of (1) a non-boundary cell not including a boundary surface of the object and located in the interior or the outside region of the object, and (2) a boundary cell including the boundary surface of the object" as recited in claims 1, 7 and 20; (b) that "modified Octree division comprises the steps of: i. re-dividing by Octree division only boundary cells, wherein each boundary cell is divided into smaller cells, and each smaller cell is then classified as either a non-boundary cell or a boundary cell; and ii. acquiring cut points..., wherein re-division of only boundary cells is performed until sufficient cut points are acquired to reconstruct boundary shape elements, including boundary surfaces, included in the external data" as recited in claims 1, 7 and 20; and (c) "acquiring cut points by replacing each boundary cell, either strictly or approximately, by cut points on twelve ridge lines in three dimensions and on four ridge lines in two dimensions" as recited in claims 1, 7 and 20, in accordance with the present invention. All of the remaining claims depend, either directly or indirectly, upon claims 1, 7 and 20 and are likewise allowable.

Furthermore, the Examiner has not considered the evidence of nonobviousness submitted by the Applicants, which demonstrate the recognition by others of the merits of the present invention, and further weighs in favor of patentability of the present claims.

For all of the above reasons, claims 1, 4-7, 10-17 and19-21 are in condition for allowance and a prompt notice of allowance is earnestly solicited. The below-signed attorney for applicants welcomes questions.

Respectfully submitted,

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